Name: Jianzhi Yang

Affiliation: University of Aveiro

Title: Einstein-Maxwell-dilaton neutral black holes in strong magnetic fields: topological charge, shadows and lensing

Abstract: The light rings (LRs) topological charge (TC) of a spacetime measures the number of stable LRs minus the number of unstable LRs. It is invariant under smooth spacetime deformations obeying fixed boundary conditions. Asymptotically flat equilibrium black holes (BHs) have, generically, TC $= -1$. In Einstein-Maxwell theory, however, the Schwarzschild-Melvin BH - describing a neutral BH immersed in a strong magnetic field - has TC $= 0$. This allows the existence of BHs without LRs and produces remarkable phenomenological features, like panoramic shadows. Here we investigate the generalised Schwarzschild-Melvin solution in Einstein-Maxwell-dilaton theory, scanning the effect of the dilaton coupling a. We find that the TC changes discontinuously from TC $= 0$ to TC $= -1$ precisely at the Kaluza-Klein value $a = \sqrt{3}$, when the (empty) Melvin solution corresponds to a twisted Kaluza-Klein reduction of five-dimensional flat spacetime, i.e.the dilaton coupling a induces a topological transition in the TC. We relate this qualitative change to the Melvin asymptotics for different a. We also study the shadows and lensing of the generalised Schwarzschild-Melvin solution for different values of a, relating them to the TC.